

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Svensson, et al.
Title : SYSTEM AND METHOD FOR POWER-EFFICIENT CHARGING AND
DISCHARGING OF A CAPACITIVE LOAD FROM A SINGLE SOURCE
Application for Reissue of U.S. Patent No. 5473,526
Issued : December 5, 1995
Reissue
Serial No.: 08/986,327
Reissue
Filed : 12/5/97 :

Commissioner of Patents and Trademarks
Washington, DC 20231

Declaration and Power of Attorney for Reissue Application
Pursuant to 37 C.F.R. §1.171 et seq.

Sir:

We, Lars Svensson, William C. Athas, and Jeffrey G. Koller, hereby declare that our residences, Post Office addresses and citizenships are as stated below next to our names, and we believe we are the original and joint inventors of the invention entitled SYSTEM AND METHOD FOR POWER-EFFICIENT CHARGING AND DISCHARGING OF A CAPACITIVE LOAD FROM A SINGLE SOURCE described and claimed in the reissue specification filed December 5, 1997 as Application No. 08/986,327 and also described and claimed in our original application No. 08/231,637 filed April 22, 1994, and

"EXPRESS MAIL" Mailing Label Number EM32064078845
Date of Deposit 7-8-98

I hereby certify under 37 CFR 1.10 that this correspondence is being deposited with the United States Postal Service as "Express Mail Post Office To Addressee" with sufficient postage on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

William C. Athas
WILLIAM C. CLARK

the resulting United States Patent No. 5,473,526, which issued December 5, 1995; and for which invention a reissue patent is solicited; that we have reviewed and understand the contents of that specification, including the claims, as amended by any⁴ amendments specifically referred to in this Declaration; that we acknowledge the duty to disclose information of which we are aware and which is material to the examination of the application in accordance with U.S. law and specifically 37 C.F.R. §1.56(a);

That we verily believe that through error, without any deceptive intent, the said patent is partly inoperative or invalid by reason of our claiming less than we had a right to claim.

The error arose during prosecution due to a misunderstanding of the proper scope of our invention commensurate with the prior art. We understand that the misunderstanding occurred as follows.

The application was originally filed with claims 1-11. Applicants and their counsel believed that these claims were patentable over the prior art applied by the Examiner during the prosecution. Thus, no claim amendments were made.

Applicants and their counsel did not appreciate that they were in fact entitled to broader claim coverage. For example, Applicants did not appreciate that the claimed "plural capacitive elements" could be claimed more broadly without running afoul of the prior art.

After U.S. Patent No. 5,473,526 was issued, a licensee of the assignee was examining the issued claims and noticed that certain claim limitations appeared overly restrictive. The licensee proposed broadening changes to the claims. The licensee believed such broader claims were novel over the cited prior art.

After further study, we agreed that such claims were patentable. The error in the original prosecution which rendered the original patent inoperative or invalid was based on misunderstanding the invention and the specific scope of the novel features of the invention.

We therefore believe that U.S. Patent No. 5,473,526 is inoperative or invalid by reason of our claiming less than we had a right to claim in the patent. The new claims which are presented herein make up this deficiency. The errors relied on arose during prosecution, and were found during a post-issuance study of the technology and the '526 patent. The errors arose without deceptive intent.

We, Lars Svensson, William C. Athas and Jeffrey G. Koller, joint inventors for the above-captioned U.S. Letters Patent, which is the subject of the accompanying application for the reissue, hereby agree to surrender the above-captioned U.S. Letters Patent upon the granting of this reissue.

We hereby state that we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We acknowledge the duty to disclose all information we know to be material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56(a).

We hereby appoint the following attorneys and/or agents to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

William E. Booth, Reg. No. 28,933; Peter J. Devlin, Reg. No. 31,753; Willis M. Ertman, Reg. No. 18,658; David L. Feigenbaum, Reg. No. 30,378; Janis K. Fraser, Reg. No., 34,819; John W. Freeman, Reg. No. 29,066; Timothy A. French, Reg. No. 30,175; Alan H. Gordon, Reg. No. 26,168; Scott C. Harris, Reg. No. 32,030; Mark J. Hebert, Reg. No., 31,766; Gilbert H. Hennessey, Reg. No. 25,759; Charles Hieken, Reg. No. 18,411; Robert E. Hillman, Reg. No. 22,837; John Land, Reg. No. 29,554; G. Roger Lee, Reg. No. 28,963; Steven E. Lipman, Reg. No. 30,011; Gregory A. Madera, Reg. No. 28,878; Ralph A. Mittelberger, Reg. No. 33,195; Robert C. Nabinger, Reg. No., 33,431; Frank P. Porcelli, Reg. No. 27,374; Eric L. Prahl, Reg. No. 32,590; Richard M. Sharkansky, Reg. No. 25,800; John M. Skenyon, Reg. No. 27,468; Michael O. Sutton, Reg. No. 26,675; Rene D. Tegtmeier, Reg. No. 33,567; Hans R. Troesch, Reg. No. 36,950; John N. Williams, Reg. No. 18,948; Gary A. Walpert, Reg. No. 26,098; John R. Wetherell, Jr., Reg. No. 31,678; Dorothy P. Whelan, Reg. No., 33,814; Mark D. Wiczorek, Reg. No. 37,966; and Charles C. Winchester, Reg. No. 21,040.

Address all telephone calls to Scott C. Harris at telephone number 619/678-5070.

Address all correspondence to Scott C. Harris, Fish & Richardson P.C., 4225 Executive Square, Suite 1400, La Jolla, California 92037.

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or

imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Full Name of Inventor: Lars SVENSSON

Inventor's Signature: [Signature] Date: 6/9/98

Residence Address: Lund, Sweden

Citizen of: SWEDEN

Post Office Address: Domherrevagen 6A, Se-22731, Lund, Sweden

Full Name of Inventor: William C. ATHAS

Inventor's Signature: _____ Date: _____

Residence Address: _____

Citizen of: U.S.

Post Office Address: _____

Full Name of Inventor: Jeffrey G. KOLLER

Inventor's Signature: _____ Date: _____

Residence Address: _____

Citizen of: U.S.

Post Office Address: _____

imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Full Name of Inventor: Lars SVENSSON

Inventor's Signature: _____ Date: _____

Residence Address: Lund, Sweden

Citizen of: SWEDEN

Post Office Address: Domherrevagen 6A, Se-22731, Lund, Sweden

Full Name of Inventor: William C. ATHAS

Inventor's Signature: William C. Athas Date: 6/8/98

Residence Address: 437 Camino de las Colinas, Torrance, California

Citizen of: U.S.

Post Office Address: 437 Camino de las Colinas, Redondo Beach, Calif. 90272

Full Name of Inventor: Jeffrey G. KOLLER

Inventor's Signature: Jeffrey G. Koller Date: 6/8/98


Residence Address: 22330 MEYLER ST #1, TORRANCE, CALIFORNIA

Citizen of: U.S.

Post Office Address: 22330 MEYLER ST #1, TORRANCE, CA 90502

PATENT

I hereby certify that on June 19, 2000, which is the date I am signing this certificate, I am depositing this document and all listed attachments with the United States Postal Service in an envelope as "Express Mail Post Office to Address" mailing Label Number EL502380455US addressed to Honorable Commissioner of Patents and Trademarks, Washington, D.C. 20231


Jessica S. Brown

Applicant: Svensson, Lars G. et al.
Reissue Application Serial No.: 08/986,327
Reissue Application Filed: December 5, 1997
U.S. Patent No.: 5,473,526
Issue Date: December 5, 1995
Title: SYSTEM AND METHOD FOR
POWER-EFFICIENT CHARGING
AND DISCHARGING OF A
CAPACITIVE LOAD FROM A
SINGLE SOURCE
Examiner: Adolf Berhane
Group Art Unit: 2838

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

SUPPLEMENTAL REISSUE DECLARATION

Dear Sir:

We, Lars Svensson, William C. Athas and Jeffrey G. Koller are the inventors of this reissue application and state that every error in the patent which was corrected in the present reissue application, and is not covered by the prior declaration submitted in this application, arose without any deceptive intention on the part of the applicant.

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States

Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: _____, 2000

Lars Svensson

Dated: May 17, 2000

William C. Athas

Dated: _____, 2000

Jeffrey G. Koller

FOOTED 18036-20

PATENT

I hereby certify that on May 19, 2000, which is the date I am signing this certificate, I am depositing this document and all listed attachments with the United States Postal Service in an envelope as "Express Mail Post Office to Address" mailing Label Number EL502380455US addressed to Honorable Commissioner of Patents and Trademarks, Washington, D.C. 20231

Jessica S. Brown
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Code and that such will be false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: May 22, 2000

Lars Svensson
Lars Svensson

Dated: _____, 2000

William C. Athas

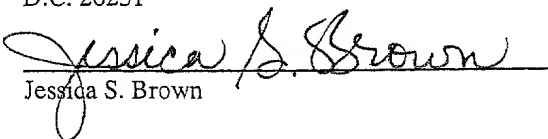
Dated: _____, 2000

Jeffrey G. Koller

FILED

PATENT

I hereby certify that on ~~May 14~~ ^{to June 14}, 2000, which is the date I am signing this certificate, I am depositing this document and all listed attachments with the United States Postal Service in an envelope as "Express Mail Post Office to Address" mailing Label Number EL502380455US addressed to Honorable Commissioner of Patents and Trademarks, Washington, D.C. 20231


Jessica S. Brown

Applicant: Svensson, Lars G. et al.
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Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

SUPPLEMENTAL REISSUE DECLARATION

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Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

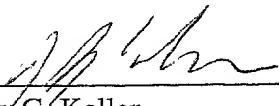
Dated: _____, 2000

Lars Svensson

Dated: _____, 2000

William C. Athas

Dated: May 30, 2000



Jeffrey G. Koller

FILED

Docket No. 18036-20
PATENT

I hereby certify that this correspondence is being deposited on January 10, 2001, with the United States Postal Service Express Mail Service, Receipt No. E1766453736 US, in an envelope addressed to: Box CPA, Honorable Commissioner of Patents and Trademarks, Washington, D.C. 20231

Joy Michaels

Joy MICHAELS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Lars G. SVENSSON et al.

Title: SYSTEM AND METHOD FOR POWER-EFFICIENT CHARGING AND DISCHARGING OF A CAPACITIVE LOAD FROM A SINGLE SOURCE

Serial No.

Filed:

Group Art Unit:

Examiner:

DECLARATION OF WILLIAM C. ATHAS (RULE 132)

I, William C. Athas, declare that:

1. I am one of the inventors of this Continued Prosecution Application for a reissue patent.
2. Since August 2000 I have held the position of VLSI Systems Architect for Apple Computer, in Cupertino, CA. At Apple I am involved in the design and analysis of high-performance integrated circuits and systems that are used in Apple computer products. From February 2000 to August 2000 I was the Director of the Laboratory for Advanced Device Technology at the House Ear Institute. My position at the Institute was to develop VLSI architectures for extremely low-power digital signal processing integrated

Received Time Jan. 9. 6:03PM

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circuits. From August 1991 to February 2000 I was a Senior Project Leader in the Information Sciences Institute and a Research Assistant Professor of the Electrical Engineering - Systems Department of the University of Southern California. I received a Ph.D., Masters and Bachelors degree in Computer Science from the California Institute of Technology. I have been involved in numerous research projects, published numerous papers, taught, advised, received numerous patents, and am a member of numerous professional associations related to the technology of this patent application. More specific information about my background is set forth on the resume that is attached as Exhibit 1.

3. The Examiner stated in the final Office Action (mailed August 11, 2000) in the parent to this case (serial number 08/986,327) (Prior Final Office Action) that it would have been obvious to one having ordinary skill in the art [at] the time of the invention to replace the voltage source of applicant s admitted prior art [Fig. 2 of this application] with the charge storage element of Masuda et al. [U.S. Patent 4,107,757] in order to provide [a] steady and cost effective power source.
4. I have carefully reviewed Masuda et al. and must respectfully disagree. It is my opinion that:
- a. our invention is not taught by this art, alone or in combination;
 - b. there is no teaching or suggestion in this art to modify the combination in the manner of our invention;
 - c. our invention produces new and unexpected results;

Serial No. 08/986,327

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- d. even experts doubted that our invention would work; and
- e. eliminating the inductor — a core feature of our invention -- was so innovative that this change was recited as the title of a contemporaneous article about our invention.

I will now explain each of these points.

5. All of the pending claims now recite the limitation that energy is recovered from the capacitive load (or just load in Claim 30) and that the recovered energy is always stored substantially only in capacitance.¹ Neither the admitted prior art (Fig. 2 of the present continuation reissue application) or Masuda et al. teach these features, either alone or in combination.
6. The Examiner does not dispute that these features are missing from the admitted prior art. However, the Examiner states in the Prior Final Office Action that Masuda et al. teaches that a charge storage element as C1 in figure 1 can be used as a voltage source. But this is not responsive to the limitation that is now recited in the pending patent claims. Rather, all of these pending claims now require that the energy always be stored substantially only in capacitance (emphasis added). Nowhere in Masuda et al. is such a concept taught or even suggested. Thus, combining what Masuda et al. teaches with the admitted prior art would not produce our invention.

¹ The phrase substantially only in capacitance is also intended to embrace capacitive systems that have a small amount of inductance due to stray or parasitic inductance or even the intentional inclusion of a small discreet inductor. What is intended to be excluded are systems such as Masuda in which a large portion of the recovered energy is stored in inductance at some point during the recycling process.

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7. There is also nothing in the prior art that suggests modifying the combined teachings of Masuda et al. and the admitted prior art in such a way as to produce our invention. To the contrary, the circuit in Fig. 1 of Masuda et al. would not even recover energy if the inductor L was eliminated, i.e., if it was modified so that its recovered energy was stored substantially only in capacitance (emphasis added) as now required by every claim.
8. Masuda and our invention also operate in fundamentally different ways.
9. In Masuda, two energy domains are required to recover energy. The first is the electrical domain of the capacitor C1. The second is the magnetic domain of the inductor L. Energy commutes between these two domains to generate a transient oscillation that peaks at twice the voltage that is across the capacitor C1. This creates a differential between the voltage that is delivered to the load 20 and the voltage across the capacitor C1, thus facilitating the transfer of energy from the load 20 back to capacitor C1.
10. Our invention, on the other hand, does not use two energy domains, does not have any resonant circuit, and does not generate any transient oscillations. The necessary voltage differential between the load 12 and the capacitor 18 is created by a totally different mechanism the use of an independent voltage supply V that is higher than the voltage developed across the capacitor 18.
11. A good analogy to Masuda is a very large source water tank for the source capacitor C1, a small load water tank for the load 20, a pump with a heavy rotator for the inductor L, a filling valve for the switch S0, and an emptying valve for the switch S1.

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12. Initially, the source tank is half full, the load tank is empty, and the valves are closed. To begin filling the load tank, the filling valve is opened. The higher water level in the source tank causes a pressure that forces the water through the pump and into the load tank. In the meantime, the pump rotator begins to rotate and picks up speed. When the load tank becomes half full, the level of the water in the source and load tank become equal. Yet, the heavy rotator in the pump keeps rotating due to inertia, causing additional water to be drawn from the source tank into the load tank. The pump will stop just about when the load tank is full. The filling valve is then closed.
13. When it is time to empty the load tank, the emptying valve is opened and the same process repeats in reverse.
14. Just like the inductor in Masuda, however, the pump in this analogy is bulky and expensive. Just like with Masuda, however, there is no suggestion in this analogy on a way to eliminate the pump. To the contrary, and also just like Masuda, the system would not even work if the pump is eliminated. The load tank would fill half way and then could not be emptied without wasting water (energy in Masuda), c.g. by drilling a hole in the bottom of the load tank.
15. Our invention also produces new and unexpected results.
16. In order to shuttle energy back and forth between the load 20 and C1 in Masuda et al., the sine-wave-shaped current through the inductor must be interrupted at the very moment it crosses zero. Otherwise, noisy and undesirable ringing and high voltage transients would

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result. As a practical matter, however, this is difficult to do. It requires precise timing circuitry and, even with this, can be noisy and create high voltage transients.

17. Our invention, on the other hand, shuttles current between the load 12 and the storage capacitor 18 without any ringing, high voltage transients or critical timing circuitry. The necessary differential between the load voltage and the tank capacitor 18 is created by a totally different mechanism switching in the higher potential source V -- not by generating transient oscillations.

18. The ordinary skilled artisan would not have expected capacitors to work in lieu of the power supplies used in the admitted prior art. How would it work? How would voltages be developed across the capacitors in Fig. 3? How would the voltages be set to their needed step values? How would these voltages be maintained when current is repeatedly drained from the capacitors during the charging cycles?

19. Even experts doubted that our invention would work.

20. We submitted an article describing the circuit shown in Fig. 3 and explaining how it worked to one of the premier scientific publications for electronic engineers, *The Journal of Solid State Circuits*. As was their custom, they submitted the article to an expert in the field for review. This expert reported that, in his opinion, the circuit would not be stable unless charging was exceedingly slow. This opinion was cited by the *Journal* as a reason for its decision not to publish our article.

21. A similar event occurred during a conference of the IEEE Symposium on Low Power Electronics in 1994. After presenting the new circuit shown in Fig. 3, I was told that Dr.

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John Denker — a scientist at Bell Labs working in this filed — stood up and said that, in his opinion, our circuit would not work because the voltages would not converge to their needed values.

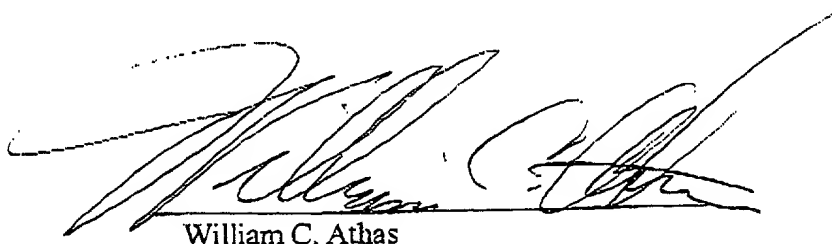
22. In fact, it took complex mathematical computations to prove that our circuit works.

Attached as Exhibit 2 is an article in which those computations are set forth.

23. The approach that we took to eliminate the inductor so that the energy is stored substantially only in capacitance (emphasis added) was so innovative that it was recited as the title of an article about our invention, Adiabatic charging without inductors, a copy of which is attached as Exhibit 3.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: January 09, 2001



William C. Athas

PATENT

Matter No.: 18036-20

Reissue Application Serial No. 08/986,326

Inventors: SVENSSON, Lars G. et al.

Title: SYSTEM AND METHOD FOR POWER-EFFICIENT
CHARGING AND DISCHARGING OF A
CAPACITIVE LOAD FROM A SINGLE SOURCE

Assignee: University of Southern California

Reissue Filing Date: December 5, 1997

(Patent No.: 5,473,526

Issued: December 5, 1995)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Assistant Commissioner for Patents
Washington, D.C. 20231

REVOCATION AND SUBSTITUTE POWER OF ATTORNEY

Sir:

University of Southern California, having become the owner of all rights to this application by virtue of an Assignment executed by the inventors and recorded at Reel 0744, Frame 0586, on June 17, 1994, hereby revokes all power of attorney heretofore given in the above-captioned reissue application and hereby appoints:

W. Poms, Reg. 18,782	M. E. Brown, Reg. 28,590	J. D. Voelzke, Reg. 37,957
G. P. Smith, Reg. 20,142	E. F. O'Connor, Reg. 25,903	G. L. Fountain, Reg. 36,374
H. D. Jastram, Reg. 19,777	A. P. Block, Reg. 35,450	C. J. Lervick, Reg. 35,244
C. A. S. Hamrick, Reg. 22,586	S. R. Hansen, Reg. 38,486	C. Rosenberg, Reg. 31,464
G. E. Lande, Reg. 22,222	D. N. Larson, Reg. 29,401	S. M. Parker, Reg. 36,233
A. C. Rose, Reg. 17,047	J. W. Inskeep, Reg. 33,910	R. S. Tamura, Reg. 43,179
L. J. Bovasso, Reg. 24,075	J. Boyce, Reg. 40,920	C. W. Thompson, Reg. 36,947
D. J. Oldenkamp, Reg. 29,421	R. O. Guillot, Reg. 28,852	J. P. Weir, Reg. 43,253
C. Darrow, Reg. 30,166	C. Berman, Reg. 29,249	G. P. Wood, Reg. 28,133
M. D. Harris, Reg. 26,690	M.B. Farber, Reg. No. 32,612	B. Canter, Reg. No. 34,792
K. A. MacLean, Reg. 31,118	B.H. Bedi, Reg. No. 39,904	C.W. Chou, Reg. No. 41,672
L. C. Cullman, Reg. 39,645	E.G. Beers, Reg. No. 40,508	M.K. Bosworth, Reg. No. 28,186
J.W. Inskeep, Reg. No. 33,910		

whose address is:

OPPENHEIMER WOLFF & DONNELLY LLP

2029 Century Park East, 38th Floor

Los Angeles, California 90067

Telephone (310) 788-5000

Fax (310) 788-5100

Attn: Marc E. Brown, Esq.

Direct Telephone: (310) 788-5032

their attorneys to prosecute the application and to transact in connection with the application all business in the Patent and Trademark Office.

To the best of my knowledge and belief, title is in the assignee identified above. I am empowered to act on behalf of the assignee.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true. I make these statements with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of the application or any patent issuing from the application.

University of Southern California

Date: 10/12/99

By

Dennis F. Dougherty

Name Dennis F. Dougherty

Title Senior Vice President of Administration

RECEIVED
OCT 15 1999
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LA: 268861 v01 01/10/2001